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```
clear;clc;close all;
```

Load/Process/Collect Centroid Data from IMGs

```
dot1pos = []
dot2pos = []
load = [0,50,70,90,110,130,150,170,190]

for k = 7917:7926
    % Create an image filename, and read it in to a variable called
    imageData.
    jpgFileName = strcat('IMG_', num2str(k), '.jpg');
    if exist(jpgFileName, 'file')
        imageData = imread(jpgFileName);
        cropFrame = imcrop(imageData,[1.19051e+03,1.02251e+03,1.09198e
+03,7.7198e+02]);
        filtFrame = cropFrame(:,:,1);
        filtFrame =
        imbinarize(filtFrame,'adaptive','ForegroundPolarity','dark','Sensitivity',0.10);
        Binarizing with adaptive threshold
        filtFrame = imcomplement(filtFrame); % Filtering to Negative
        filtFrame = bwareafilt(filtFrame, [1500 10e9]); % Filtering by
        size (>1500 px, <10e9 px)
        %imshow(filtFrame)

        % Centroid and Data Extraction
        stats =
        regionprops(filtFrame,'Centroid','Area','Circularity'); % Extracting
        Centroid data
        roids = cat(1,stats.Centroid); % Creating array of centroid
        data
        data = ones(2);
        if ~isempty(roids) && isequal(size(data),size(roids))&&
        roids(1,2)>50 % Records when there are 2 centroids
            dot1 = roids(1,:);
            dot2 = roids(2,:);
```

```

        dot1pos(end+1,:)= dot1(1,:);
        dot2pos(end+1,:)= dot2(1,:);
    end
else
    continue
end
end
end

dot1pos =

    []

dot2pos =

    []

load =

    0    50    70    90   110   130   150   170   190

```

Conversion Factor

```

measuredDist = 8.33;
convfactor = measuredDist/400; %mm/pixel

```

Calculation of Displacement Between Markers

```

lowerY = dot1pos(:,1);
upperY = dot2pos(:,1);
stretchDist = (upperY-lowerY)*convfactor;
strain = stretchDist/8.33;
force = load*9.81;
stress = force/295.37;

```

Plotting

```

figure; hold on; title('Displacement vs. Load, Muscle'); xlabel('Load (g)'); ylabel('Displacement Between Markers (mm)');
plot(load,stretchDist);
ylim([7 12]);

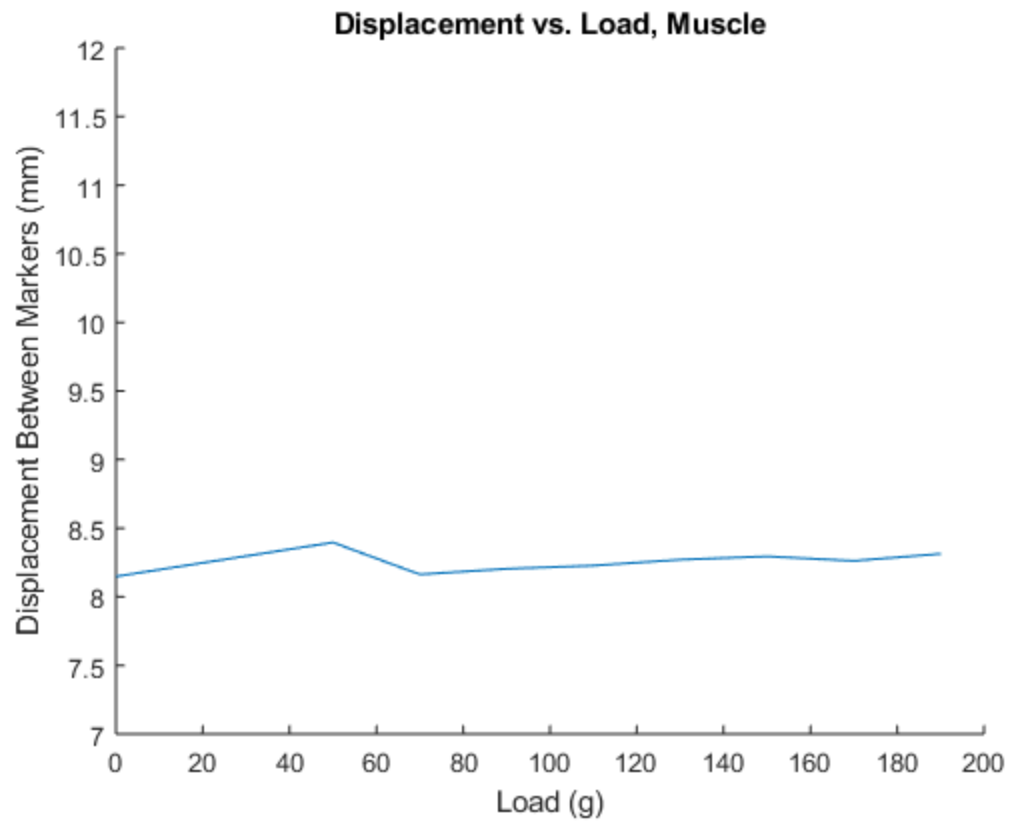
figure; hold on; title('Strain vs Load, Muscle'); xlabel('Load (g)'); ylabel('Strain');
plot(load,strain);
ylim([0 2]);

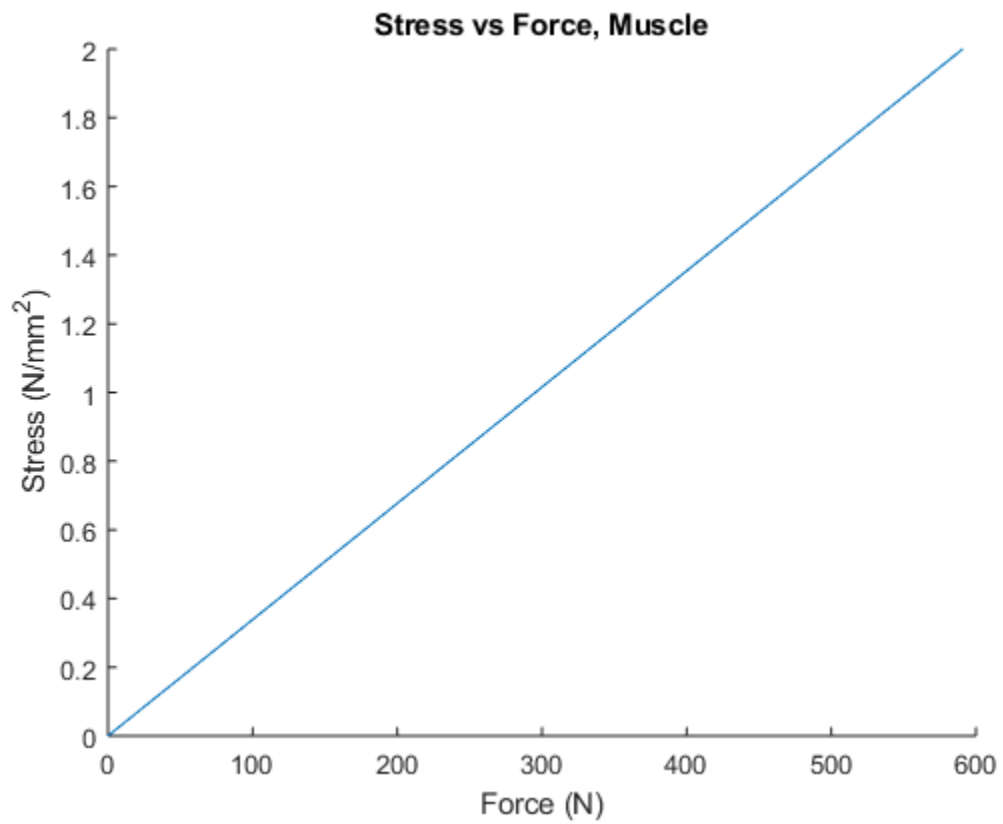
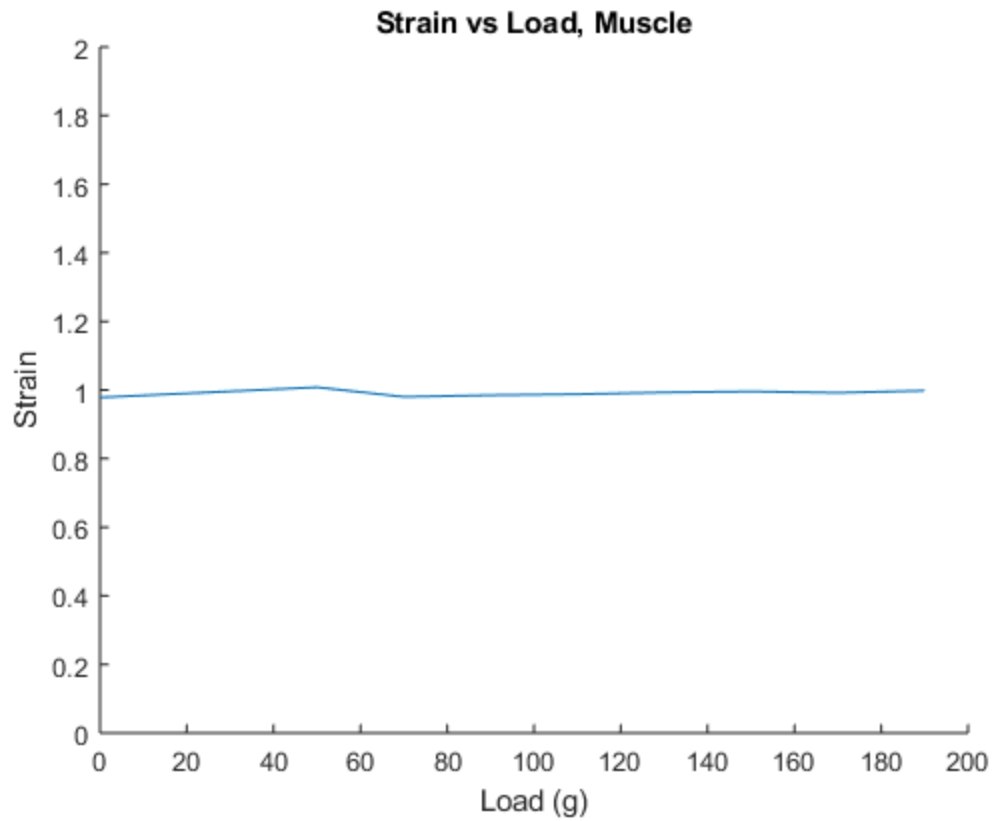
figure; hold on; title('Stress vs Force, Muscle'); xlabel('Force (N)'); ylabel('Stress (N/mm^2)');

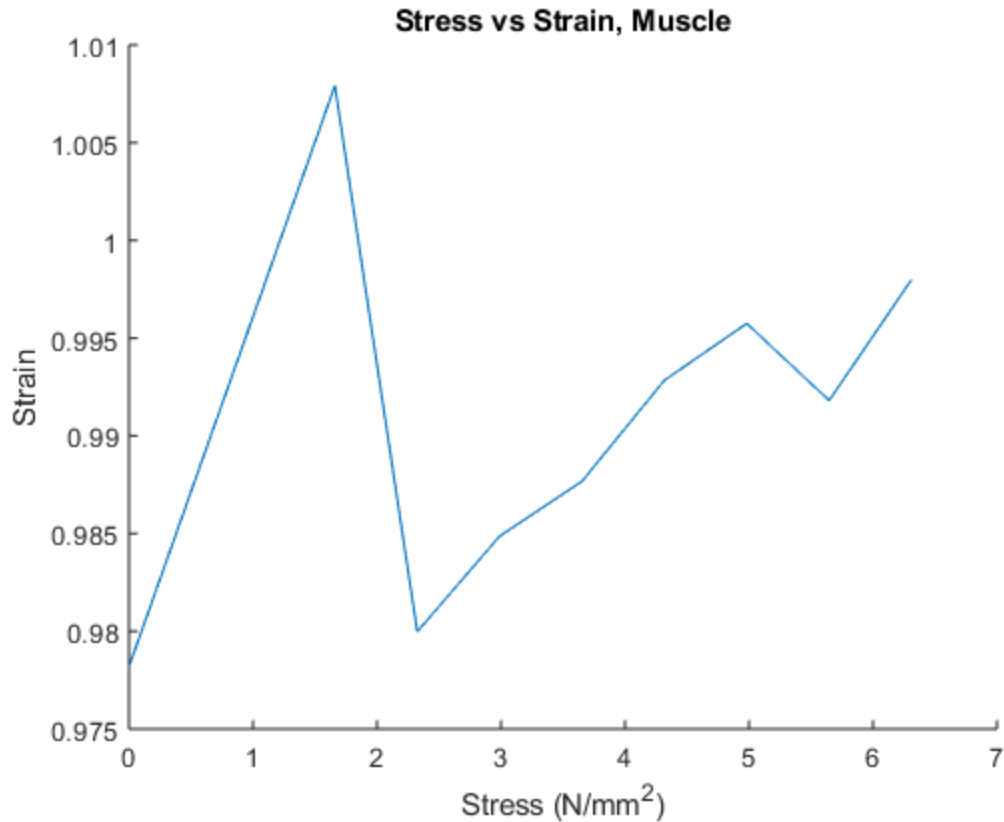
```

```
plot(force, stress);
ylim([0 2]);

figure; hold on; title('Stress vs Strain, Muscle'); xlabel('Stress (N/
mm^2)'); ylabel('Strain');
plot(stress, strain);
```







Load Video - Muscle

```
vid = VideoReader("video.MOV");

dot1motion = [];
dot2motion = [];
time = [];

while hasFrame(vid)
    curFrame = readFrame(vid);

    % Crop frame
    cropFrame = imcrop(curFrame, [3.7451e+02,5.8651e+02,4.8198e+02,4.3498e+02]);

    % Process frame
    filtFrame = cropFrame(:,:,1);
    filtFrame =
    imbinarize(filtFrame,'adaptive','ForegroundPolarity','dark','Sensitivity',0.10);
    Binarizing with adaptive threshold
    filtFrame = imcomplement(filtFrame); % Filtering to Negative
    filtFrame = bwareafilt(filtFrame, [1500 10e9]); % Filtering by
    size (>1500 px, <10e9 px)
    %imshow(filtFrame)
```

```

    % Centroid and Data Extraction
    stats = regionprops(filtFrame, 'Centroid', 'Area', 'Circularity'); %
    Extracting Centroid data
    roids = cat(1, stats.Centroid); % Creating array of centroid data

    data = ones(2);
    if ~isempty(roids) && isequal(size(data), size(roids)) &&
roids(1,2)>50 % Records when there are 2 centroids
        dot1 = roids(1,:);
        dot2 = roids(2,:);
        dot1motion(end+1,:) = dot1(1,:);
        dot2motion(end+1,:) = dot2(1,:);
        time(end+1,:) = cat(1, vid.CurrentTime);
    end
end

```

Conversion Factor

```

measuredDist = 8.33;
convfactor = measuredDist/205; %mm/pixel

```

Calculation of Displacement Between Markers

```

lowerY = dot1motion(:,2);
upperY = dot2motion(:,2);
stretchDist = abs((upperY-lowerY)*convfactor);

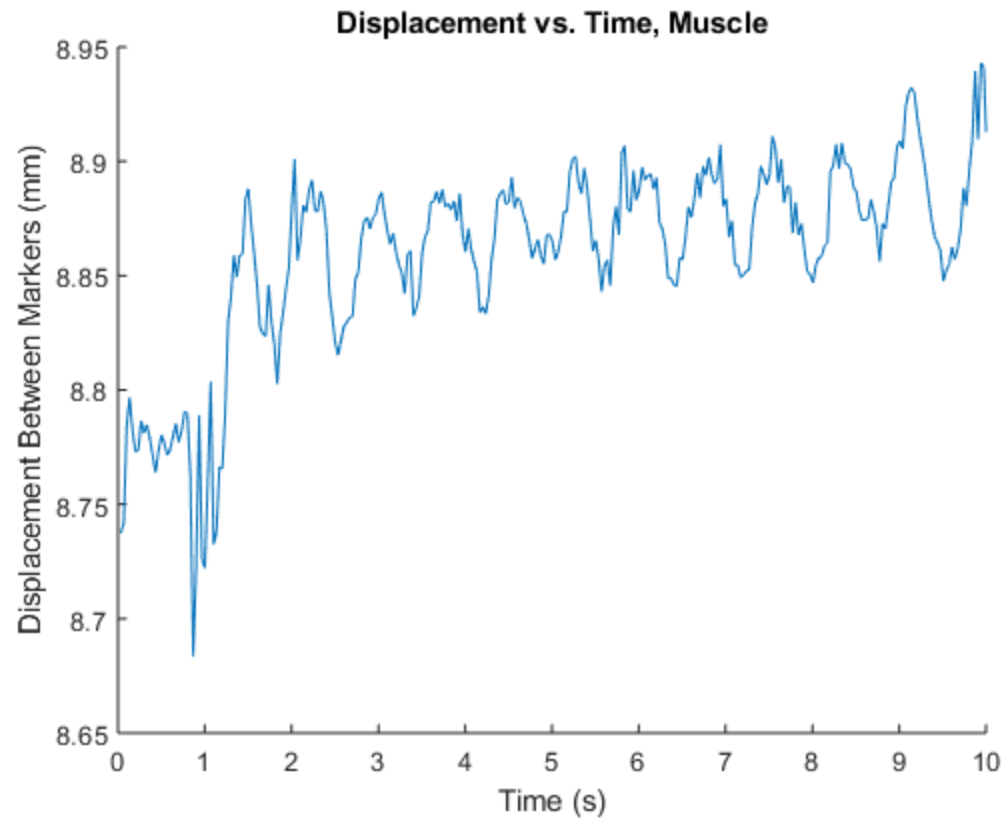
```

Plotting Displacement vs. Time

```

figure; hold on; title('Displacement vs. Time, Muscle'); xlabel('Time
(s)'); ylabel('Displacement Between Markers (mm)');
plot(time, stretchDist);
xlim([0 10]);

```



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